

1 1. An imaging device comprising:
2 an optical plate including:
3 a base made of an optically transparent material and having an index of
4 refraction, the base including an array of microstructures along a first surface, and
5 a coating deposited on the first surface of the base and forming a surface for
6 receiving a finger, the coating having an index of refraction that is different from the index of
7 refraction of the base; and
8 an imaging system positioned at a second surface of the base to receive light from the
9 finger at an observation angle measured relative to the finger receiving surface and to form
10 an image of a fingerprint pattern of the finger based on the received light.

1 2. The device of claim 1 further comprising a light source at a third surface of
2 the base to illuminate the first surface of the base.

1 3. The device of claim 2 in which the third surface is perpendicular to the first
2 surface.

1 4. The device of claim 1 in which the index of refraction of the coating is less
2 than the index of refraction of the base.

1 5. The device of claim 4 in which each microstructure comprises a surface that is
2 substantially perpendicular to an observation path such that light from the finger strikes the
3 microstructure surface at an angle substantially perpendicular to the microstructure surface.

1 6. The device of claim 1 in which the array of microstructures is defined by a
2 spatial period that is approximately two times greater than a maximum spatial period of
3 ridges in an average fingerprint pattern.

1 7. The device of claim 1 in which the coating comprises silicone.

1 8. The device of claim 1 in which the base includes a spherically-shaped
2 reflective surface positioned along a fourth surface that is approximately lateral to the first
3 surface.

1 9. The device of claim 8 in which the spherically-shaped reflective surface
2 collects light from the finger onto the imaging system positioned at the second surface.

1 10. The device of claim 8 in which the spherically-shaped reflective surface is
2 formed from a converging mirror.

1 11. The device of claim 8 in which the spherically-shaped reflective surface is
2 formed from a diverging mirror.

1 12. The device of claim 1 in which the imaging system comprises:
2 an aperture;
3 an objective at the aperture; and
4 a detector for receiving light collected by the aperture and the objective to form the
5 image of the fingerprint pattern.

1 13. The device of claim 12 in which the imaging system comprises a reflective
2 surface positioned between the objective and the detector for collecting light from the
3 objective and for focusing the light onto the detector.

1 14. The device of claim 12 in which the detector comprises a CCD.

1 15. The device of claim 12 in which the detector comprises a CMOS sensor.

1 16. The device of claim 12 in which the aperture defines an aperture beam of light
2 rays used by the detector to form the fingerprint pattern image.

1 17. The device of claim 1 in which the index of refraction of the coating is greater
2 than the index of refraction of the base.

1 18. The device of claim 17 in which each microstructure comprises a first surface
2 and a second surface that are positioned such that light striking the first surface at an angle
3 that is greater than the critical total internal reflection angle for the coating and the base
4 interface reflects from the first surface and strikes the second surface at an angle that
5 substantially coincides with a normal to the second surface.

1 19. A method of imaging a fingerprint, the method comprising:
2 providing an optical plate that includes:
3 a base made of an optically transparent material and having an index of
4 refraction, the base including an array of microstructures along a first surface, and
5 a coating deposited on the first surface of the base and forming a surface for
6 receiving a finger, the coating having an index of refraction that is different from the index of
7 refraction of the base;
8 receiving a finger at the finger receiving surface;
9 illuminating the finger receiving surface with a light source;
10 collecting light from the finger receiving surface;
11 receiving the collected light at an imaging system positioned at a second surface of
12 the base, the received light traveling at an observation angle measured relative to the finger
13 receiving surface; and
14 forming an image of a fingerprint pattern of the received finger based on the received
15 light.

1 20. The method of claim 19 further comprising positioning the light source at a
2 third surface of the base, the third surface being perpendicular to the finger receiving surface.

1 21. The method of claim 19 in which each microstructure comprises a surface that
2 is perpendicular to an observation path.

1 22. The method of claim 19 in which the array of microstructures is defined by a
2 spatial period that is approximately two times greater than a maximum spatial period of
3 ridges in an average fingerprint pattern.

1 23. The method of claim 19 in which collecting light from the finger includes
2 collecting the light from the finger onto the imaging system.

1 24. The method of claim 19 in which the imaging system includes an aperture, an
2 objective at the aperture, and a detector.

1 25. The method of claim 24 in which receiving light at the imaging system
2 comprises defining an aperture beam of light rays with the aperture and focusing the aperture
3 beam of light onto the detector with the objective.

1 26. The method of claim 19 in which the index of refraction of the coating is less
2 than the index of refraction of the base.

1 27. The method of claim 26 in which each microstructure comprises a surface
2 having a normal that substantially coincides with an observation path such that light from the
3 finger strikes the microstructure surface at an angle that substantially coincides with a normal
4 of the microstructure surface.

1 28. The method of claim 19 in which the index of refraction of the coating is
2 greater than the index of refraction of the base.

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1 29. The method of claim 28 in which each microstructure comprises a first surface
2 and a second surface that are positioned such that light from the finger strikes the first surface
3 at an angle that is greater than the critical total internal reflection angle for the coating and
4 the base interface and reflects from the first surface and strikes the second surface at an angle
5 that substantially coincides with a normal to the second surface.

1 30. An optical plate for use in an imaging device, the optical plate comprising:
2 a base made of an optically transparent material and having an index of refraction, the
3 base including an array of microstructures along a first surface; and
4 a coating deposited on the first surface of the base and forming a surface for receiving
5 a finger, the coating having an index of refraction that is different from the index of
6 refraction of the base.

1 31. The optical plate of claim 30 in which the base includes a second surface for
2 coupling to an imaging system and the base transmits light into the imaging system from the
3 finger at an observation angle measured relative to the surface of the coating.

1 32. The optical plate of claim 30 in which the index of refraction of the coating is
2 less than the index of refraction of the base.

1 33. The optical plate of claim 32 in which each microstructure comprises a
2 surface that is substantially perpendicular to an observation path such that light from the
3 finger strikes the microstructure surface at an angle substantially perpendicular to the
4 microstructure surface.

1 34. The optical plate of claim 30 in which the index of refraction of the coating is
2 greater than the index of refraction of the base.

- 1 35. The optical plate of claim 34 in which each microstructure comprises a first
2 surface and a second surface that are positioned such that light striking the first surface at an
3 angle that is greater than the critical angle for the coating and the base interface reflects from
4 the first surface and strikes the second surface at an angle that substantially coincides with a
5 normal to the second surface.

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